

Boiler Controller with VT Circuit

Main Features

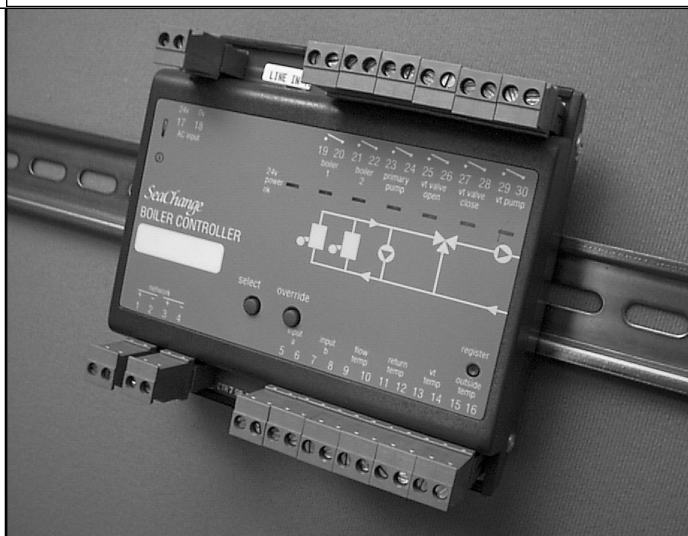
Controls 2 Boilers and associated plant

Up to 8 Boilers in one sequence using
Boiler Cascade Submodules

Self adapting Weather Compensation

System Housekeeping function option

Boiler plant operates on demand from
the building, not fixed time programme



Summary Features

General

The Boiler Controller is an Energy Provider Module in the SeaChange system; that means that it provides heat energy to Distributor Modules (perhaps controlling secondary circuits) or Consumer Modules (which are responsible for using the energy). It will only function when it receives Demand signals from these other modules; in this way, the plant will only run when it is needed, rather than on a timed basis as is common in conventional control schemes.

Configuration parameters can be set to allow operation to match the plant control requirements. A full table of configuration and monitoring parameters is detailed later in this data sheet.

A table of available product versions is shown on the back page.

Heating and DHW demand signals

The Boiler Controller will take the Consumer or Distributor Module with the highest demand as the basis for its Primary Control Temperature.

If no Domestic Hot Water or CT demands exists, the Boiler Primary Control Temperature setpoint will be based on the current setpoint of the local VT Circuit which is generated by Zone Controller demand (see Weather Compensation and Trim, later). It will be set to 5 degC above the current VT setpoint to allow the VT valve to remain under control.

If multiple demands are being received from other modules requiring Primary CT water (for instance, another VT circuit controlled by a Secondary Circuit Controller, or a Domestic Hot Water load) the Boiler Primary Control Temperature setpoint will automatically be raised to the correct value to satisfy the Module with the highest demand. Modules that require Primary (CT) water send their Demand signals in the form of a setpoint, which is high enough to account for Primary losses.

In this way, the Primary Circuit is controlled at the lowest possible temperature to satisfy all of the connected loads.

VT Circuit Temperature Control

The VT circuit will control to the Heating setpoint while any Zone Controller is demanding heat; when all Zones are satisfied, the setpoint will reduce to the FRST Frost Protection setpoint parameter and the pumps will turn off (unless the MIND Minimum Demand parameter is set to zero - see **Pump Control and Demand** later in this document). Thus the local VT Circuit controlled by the Boiler Controller will be run only when necessary, and then to the lowest possible temperature to satisfy all of the zones.

Auxiliary Power Supply connectors

are connected to the System PSU Aux supply or 24V AC to provide power for the Boiler Controller's relay coils.

Temperature Indicator

indicates how far the controlled temperature is from setpoint.
Green = close to setpoint.
Amber = above setpoint.
Red = below setpoint.
Flashes in Setup mode and when Alarm present.
See SeaChange Design Guide.

Status Lamp

indicates that the Demand signals are being received from other Controllers if lit steadily, also indicates that controller is in Configuration Mode (slow flashing) or Override Mode (see Manual Override section).

Connections

for network. Belden 8205 Twisted pair, unscreened cable is required (or exact equivalent).

Connections

for relay outputs controlling actuator and plant. See back page for details.

Auxiliary Power OK

lamp indicates that the auxiliary supply is healthy.

Output Status Lamps

indicates current status of the six relay outputs.

Override

is used to change from Normal to Override mode. Override mode will allow the plant to run without demand signals from the Zone Controllers, which is useful for plant maintenance purposes (see Manual Override section).

Registration Button

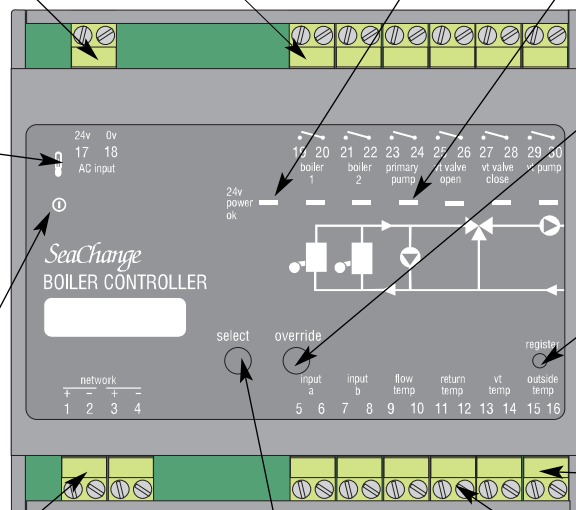
is used during the commissioning process to build logical links between controllers.

Connections

for temperature sensors, and VFC alarm inputs. Twisted pair, unscreened cable is required.

Terminals

are all of two-part construction to facilitate wiring connections.

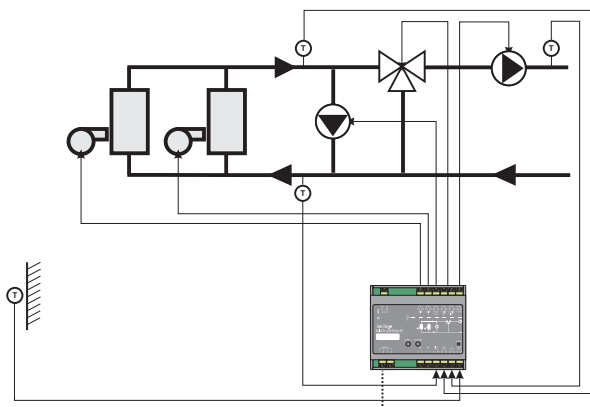
**Select**

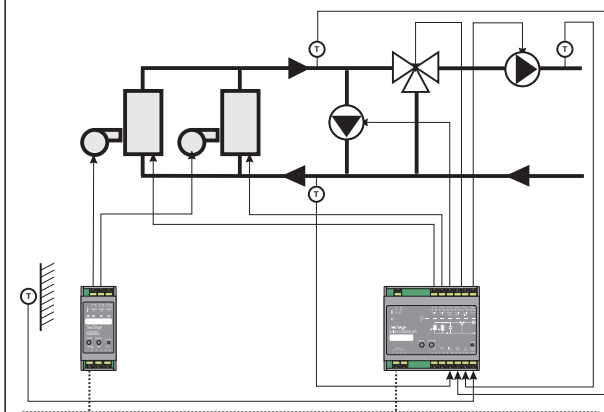
is used during commissioning to allow a Zone Controller to display the Engineering Parameters of this controller, and to set the Timing Characteristics of the valve outputs.

Typical Applications

2 Boilers or Boiler Stages with Single Primary and Secondary Pumps and Raise/Lower valve for VT Control

BLR / DIN / STD / SH / 001



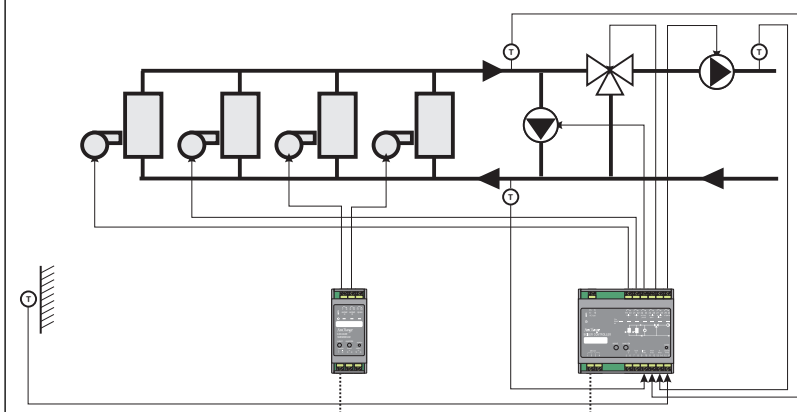


2 Modulating Boilers with 0-10Vdc Burner Control and with Single Primary and Secondary Pumps and Raise/Lower valve for VT Control

BLR / DIN / STD / SH / 001

ACT / DIN / AOP / 722

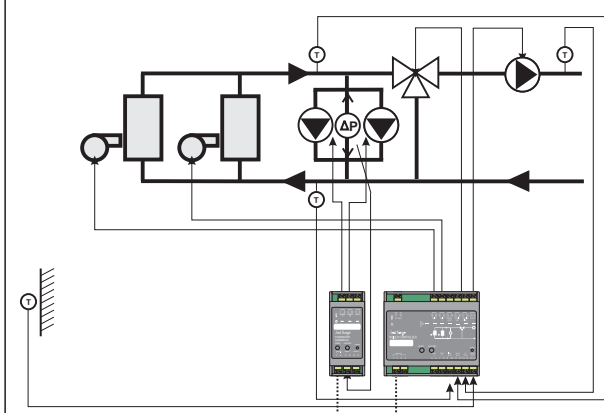
Note that modulating boilers often have special control requirements which vary between different manufacturers.
Contact SeaChange for further application advice.



4 Boilers or Boiler Stages with Single Primary and Secondary Pumps and Raise/Lower valve for VT Control

BLR / DIN / STD / SH / 001

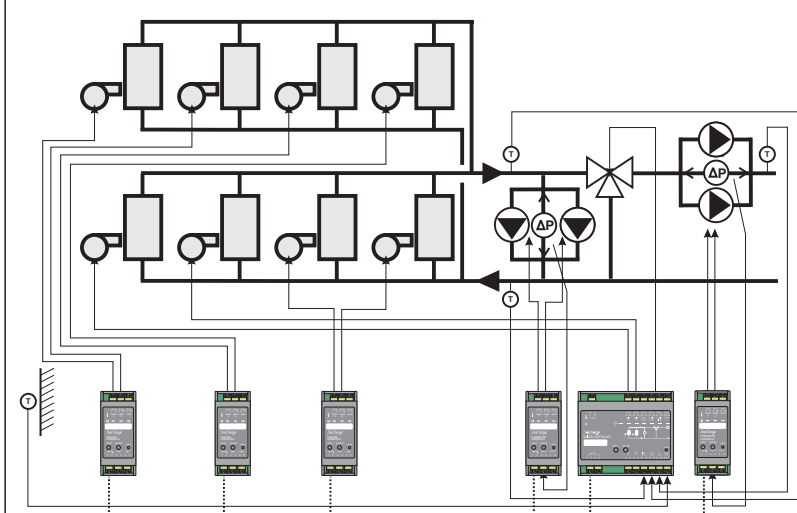
CAS / DIN / 3T / 001



2 Boilers or Boiler Stages with Twin Primary Pumps, Single Secondary Pump and Raise/Lower valve for VT Control

BLR / DIN / STD / SH / 001

PCO / DIN / 3T / 001



8 Boilers or Boiler Stages with Twin Primary and Secondary Pumps and Raise/Lower valve for VT Control

BLR / DIN / STD / SH / 001

CAS / DIN / 3T / 001 x 3

Primary Pumps

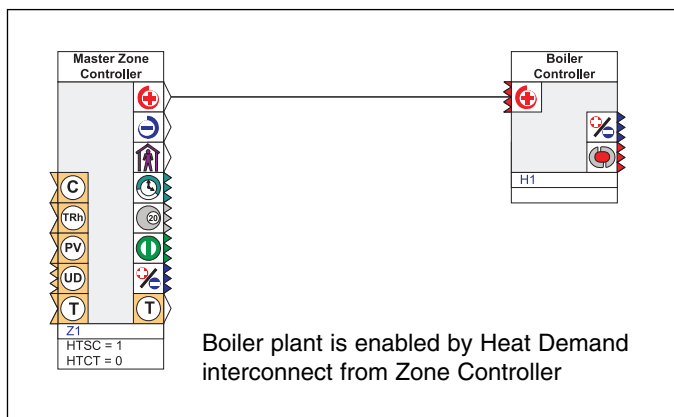
PCO / DIN / 3T / 001

Secondary Pumps

PCO / DIN / 3T / 002

Occupation Control

The Boiler Controller does not have any time settings of its own, as it is entirely Demand Driven from heating demand signals generated by other controllers. The parameter **MIND** can be used to set a minimum level of demand that will bring the boilers on. At least one Zone Controller is required in the system to set Occupation Times for the building.



The parameter **SACT** may be used to force the Boiler Controller to use flow, return or an average of both temperatures. The default setting **SACT** = 1 will control using the flow sensor only.

Parameter **MAXF** is used to set the Maximum Primary Temperature control setpoint selected by **SACT**. **MINR** is used to set the Minimum Return Temperature control setpoint, which is important for protecting some boilers against back-end corrosion. In order to maintain the Minimum Return Temperature during morning start-up, the VT Valve will limit its opening to mix the cold return water from the VT circuit with the hotter primary water; this effect can be limited, or disabled altogether, using the **VLIM** parameter, see Boiler **Back-End Protection** section.

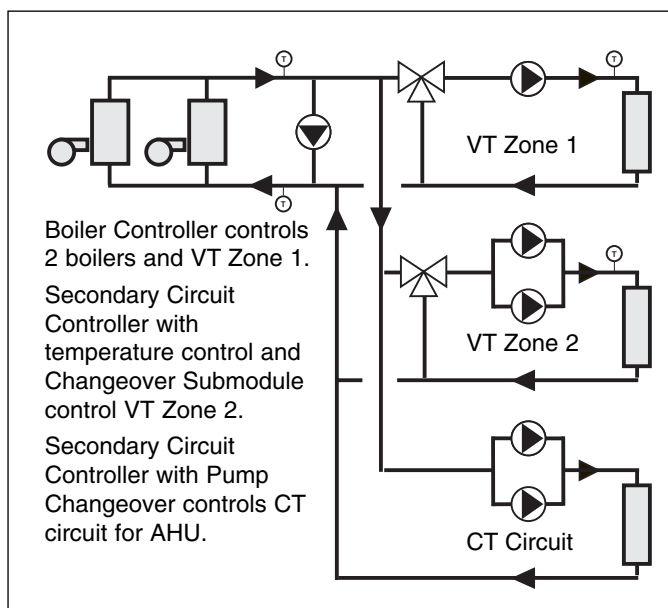
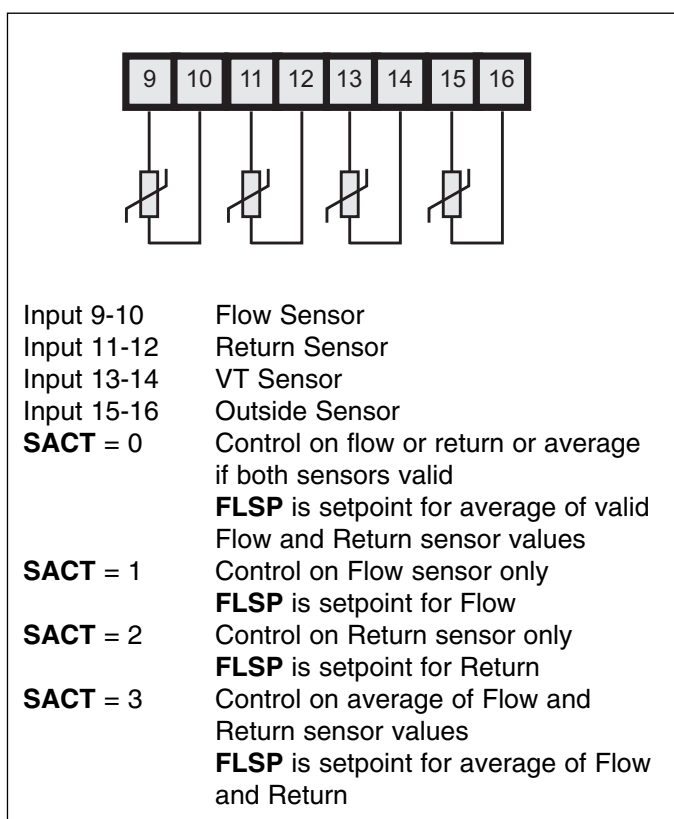
Boiler Primary Setpoint Calculation

The Boiler Controller will dynamically calculate its Primary Control Setpoint **FLSP** according to the demands received from all of the loads which the primary circuit is feeding.

Consider a typical system with 2 VT circuits, and a CT circuit feeding an AHU.

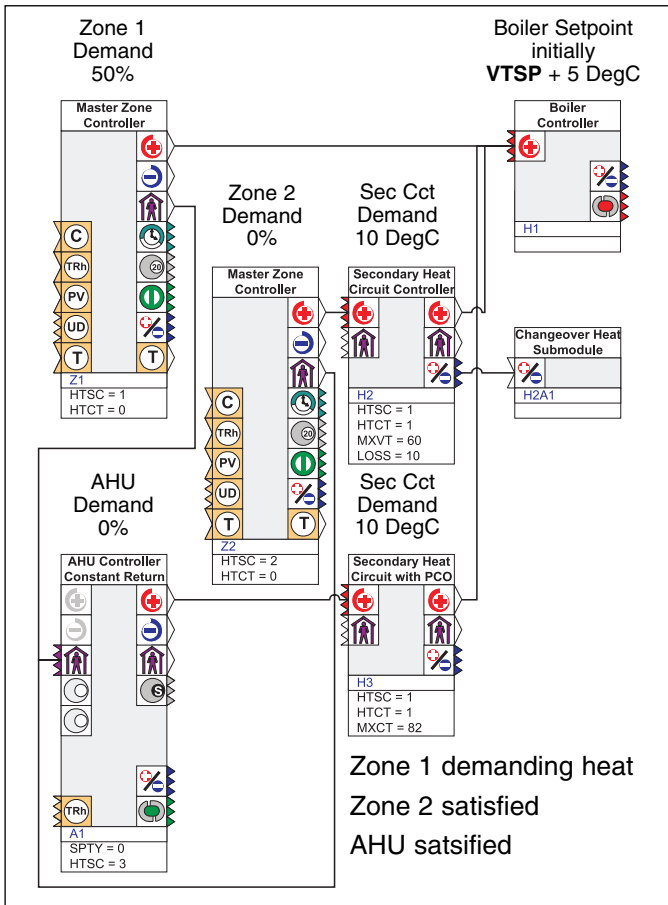
Flow & Return Temperature Control

The Boiler Controller is capable of several different methods of controlling Flow and Return Temperatures. All of them are based on the principle of controlling to the lowest possible water temperature in order to minimise circulation losses. The Controller decides which method to use depending on which sensors are connected to it. Best control is achieved using the Flow Temperature if only one sensor is used.



Boiler Primary Setpoint Calculation (Continued)

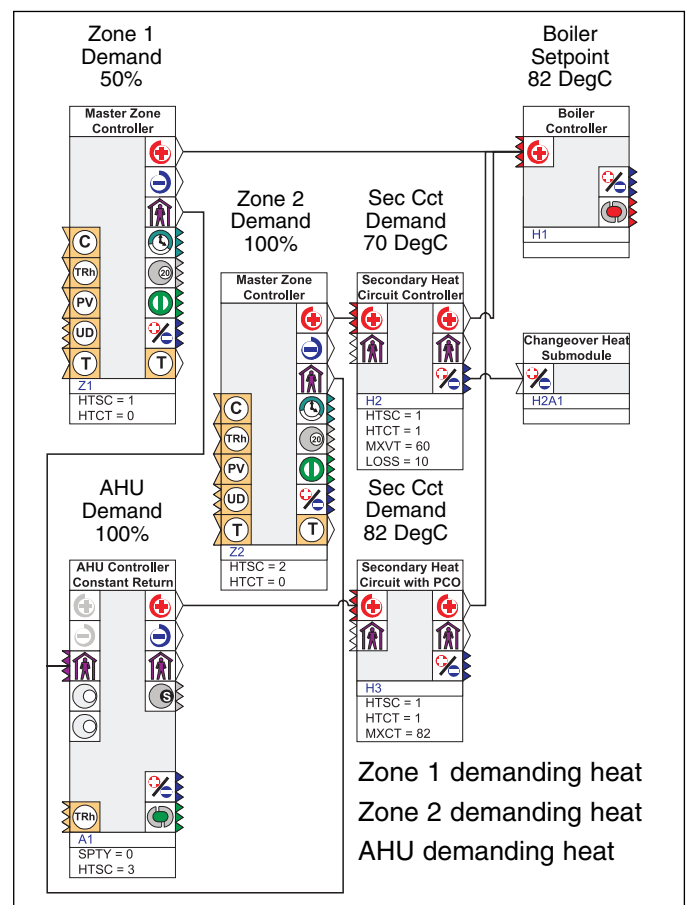
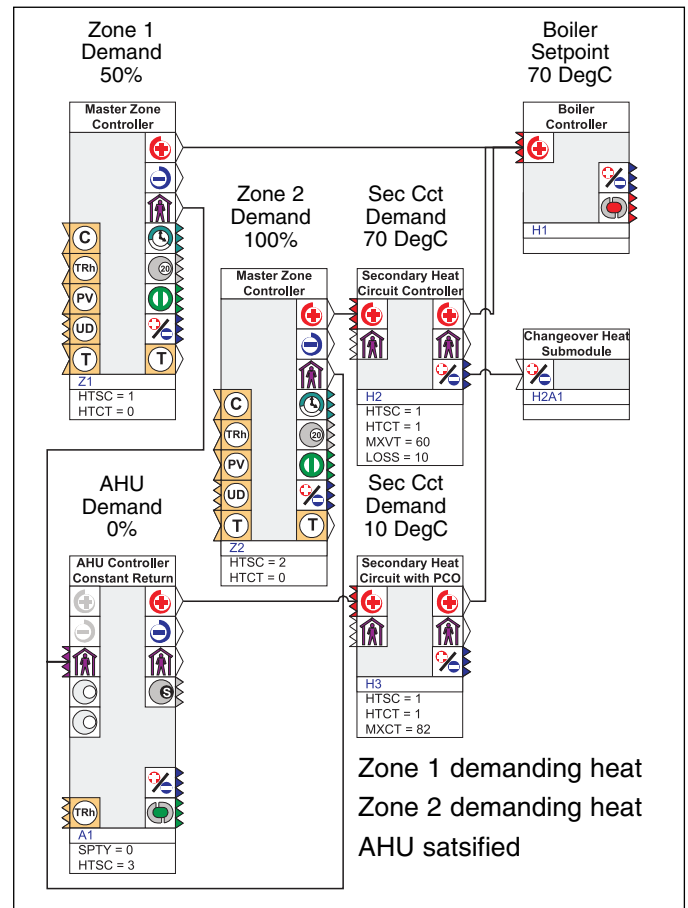
When Zone 1 is demanding heat (and all other devices are satisfied) the Boiler's own Heating Setpoint **VTSP** calculation will determine the VT Setpoint for Zone 1's circuit (see **Weather Compensation and Trim** section). Assuming there is no CT demand and that **MINR** is satisfied, the Primary Setpoint **FLSP** will be adapted from initially 5 Deg C above this Heating Setpoint **VTSP** in order to maintain valve position **VTPN** at 75%. The aim is to keep the VT valve within its control range. If the **VTPN** becomes 100%, then the boiler setpoint **FLSP** will eventually rise to **MAXF**.



If Zone 2 now demands heating, the Secondary Circuit Controller controlling Zone 2's valve will calculate a Heating Setpoint for this circuit (see Secondary Circuit Controller Data Sheet M3) and will add on an amount (determined by the Secondary Circuit's **LOSS** parameter) to produce a Constant Temperature Demand to the Boiler Controller, which will adjust its Primary Setpoint accordingly.

Finally, if the AHU is demanding heat, the Secondary Circuit Controller feeding it will send a CT Demand, and the Boiler Primary Setpoint will be elevated to the temperature needed by the AHU (probably 82 Deg C).

Thus the Boiler Controller minimises the Primary Control Temperature at all times (thereby reducing the primary heat losses to a minimum). This also means that all loads on a Boiler system need to be represented by a SeaChange module, see our 'Design Guide' publication for fuller details.



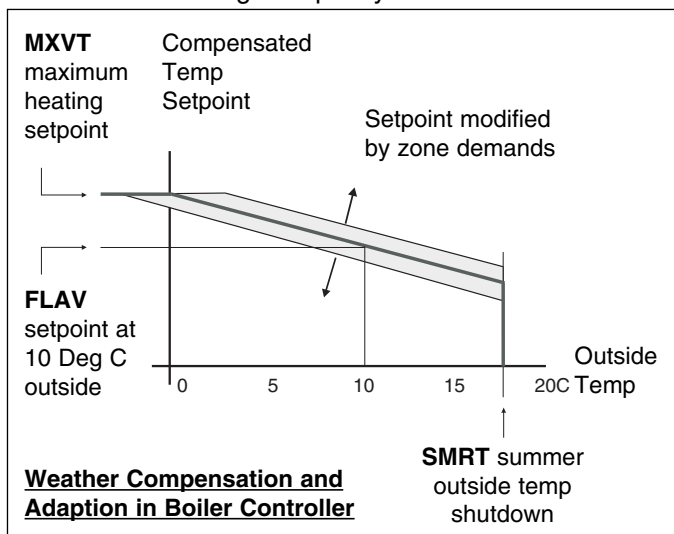
Weather Compensation and Trim

The Boiler Controller runs the Boiler Plant on the basis of demand signals that it receives from other SeaChange Controllers. For the heating circuit, the demand is received from one or more Zone Controllers, which provide Optimum Stop/Start control of the occupied space.

The Boiler Controller controls water temperature for the VT circuit according to a Weather Compensated setpoint; this is further modified by demand signals from the Zone Controllers to produce the Heating setpoint. Any Zone or Slave Zone Controllers which are registered to the Boiler Controller for the purposes of Heating Demand (i.e. their **HTSC** parameter is set to point to the Boiler Controller) and whose parameter **HTCT** is set to 0 will be used in the calculation.

Weather Compensation with Zone Trim and Adaption

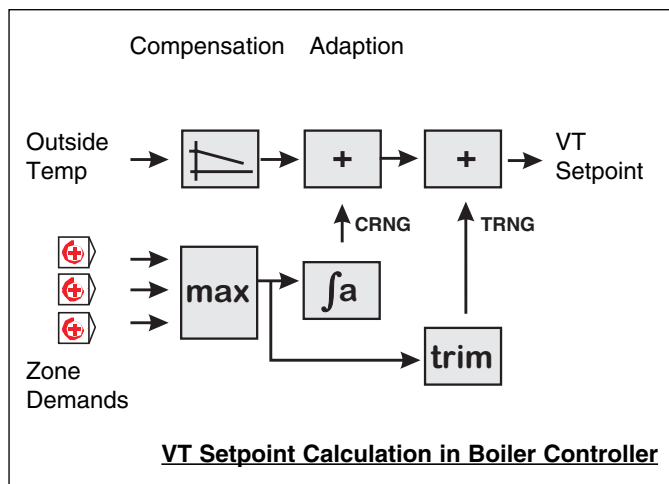
Zone Controllers produce demand signals varying between -100% (full cooling) and +100% (full heating). The Boiler Controller adapts the Weather Compensation to “learn” the building’s characteristic by keeping the highest-demanding Zone device at a +50% demand level during occupancy.



If the demand level is above or below 50%, the Weather Compensated setpoint is modified by two effects in the Fuzzy Logic Control loop; the trim effect will rapidly raise or lower the setpoint to take care of short-term changes in load.

The adaptive effect will additionally raise or lower the setpoint if the “error” from the 50% level is sustained over a long period, which represents the control system “learning” the thermal characteristic of the building.

The effects of these adaptations can be limited; the maximum excursion from the Weather Compensated setpoint caused by these effects can be set on two Configuration Parameters: **TRNG** sets the maximum trim effect, and **CRNG** sets the maximum influence of the adaptive effect.



These setpoint calculations remain active when the Controller is in an Occupied state (see **Occupation Control**, earlier in this document). At all other times, it will control to its non-occupied setpoint, **FRST**.

It is possible to disable Zone Trim and Adaption completely by setting **CRNG** and **TRNG** to 0. See **Weather Compensation without Zone Trim and Adaption** section.

Other Features

MXVT is a limit to VT flow temperature, (useful for limiting the flow temperature in underfloor heating applications), and also defines the Weather Compensated setpoint at 0 Deg C outside temperature.

FLAV defines the unadapted Weather Compensated setpoint at 10 Deg C outside temperature.

SMRT defines a summer cutoff temperature; when the outside temperature exceeds this value, the VT heating circuit will be inhibited (the primary circuit will be allowed to run for CT demands only).

Boost Mode

When any of the participating Zones are more than 1.0 DegC below their setpoint, they will drive the Heating setpoint into a Boost condition; it will temporarily leave the Compensation Curve with its adaption, and be set to the maximum permissible temperature, **MXVT**. Only when all Zones are within 1.0 Deg C of their respective setpoints will the Heating setpoint return to the adapted Compensation curve. This is done in order to perform the fastest possible Optimum Start, and also to provide a predictable heat input to the Zone in order that the Zone Controller’s Optimum Start self-adaption will work properly.

Disabling Boost Mode may be necessary if *none* of the participating Zones are reading a representative temperature (for instance, a Hotel heating system where it is impractical to put sensing in all of the rooms, and a simple Weather Compensated scheme will suffice). In this case, **ZBST** may be adjusted to disable Boost. Be aware that doing this will almost certainly disrupt the Optimum Start abilities of the system. See also **Weather Compensation without Zone Trim and Adaption**.

Weather Compensation and Trim (Continued)

Direct Compensation

If no VT sensor is fitted, the Controller will assume no VT Valve is present, and the heating setpoint will then apply to the Control Temperature in the Primary circuit instead of the VT Circuit. This is called Direct Compensation of the boilers.

Weather Compensation without Zone Trim and Adaption

In certain applications (for instance, a Hotel heating system where it is impractical to put sensing in all of the rooms) the Zone Controller(s) may not be located in positions which give adequate sensing of the whole controlled space. If the Boiler Controller was left with its default parameter settings, this would result in the boiler adapting its VT setpoint according to an inappropriate Zone Demand (see **Zone Trim and Adaption**), the Boiler Controller may stay in Boost Mode for longer than is necessary, and also the VT pump would stop when the Zone(s) were satisfied (see **Pump Control and Demand**).

In these circumstances, the Boiler Controller should be set to simplify the Weather Compensation by ignoring Zone Demands:

CRNG = 0 Disables Zone Trim and Adaption.
TRNG = 0 Disables Zone Trim and Adaption.
ZBST = 0 Disables Boost Mode.
MIND = 0 Ensures VT pumps run constantly during occupancy.

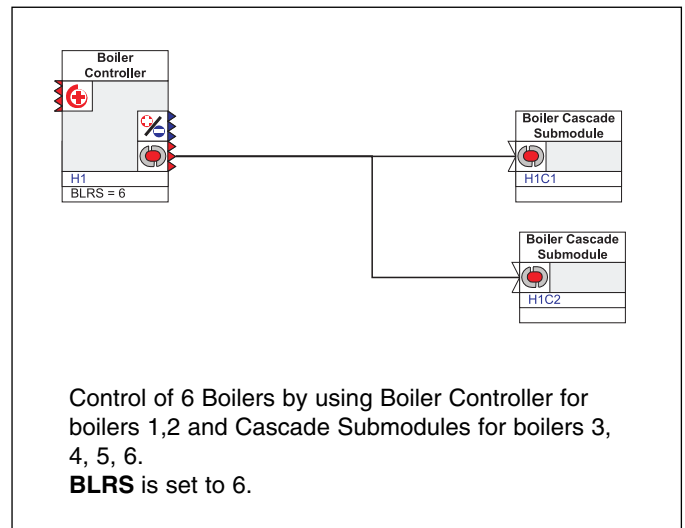
If these settings are made, the Zone Controller(s) still control the Optimum Start of the space, as well as Fabric Protection. Be aware, however, that during mid-season (i.e. when heating may not be required, but Outside Temperature has not risen above the **SMRT** setting) the VT pump will continue to run all day. To stop this happening, Occupancy Times in the Zone Controllers must be set to no occupation.

Boiler Sequencing and Duty Rotation

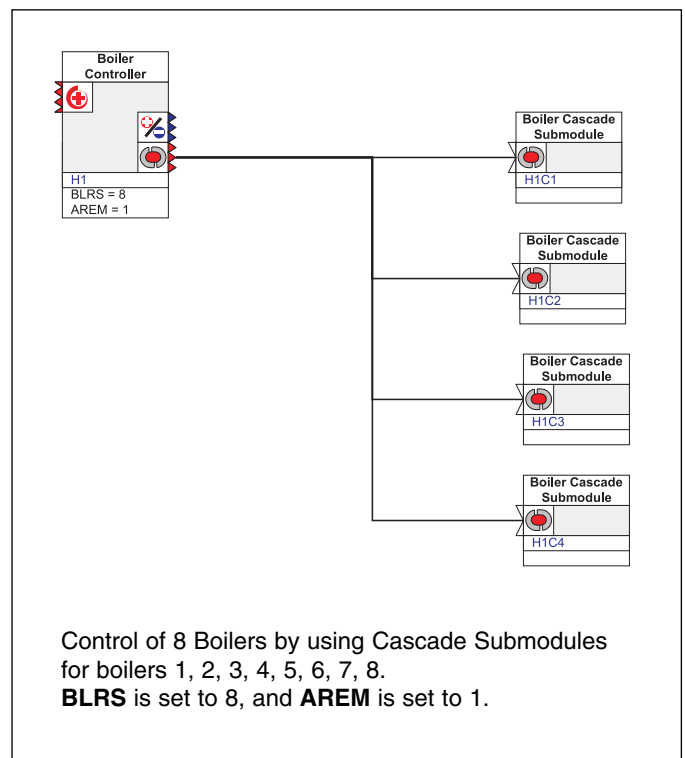
Multiple Boilers will be automatically rotated in their sequence on the basis of "longest running boiler goes off first". This shares the plant duty between the boiler stages, and also gives good controllability under part load conditions. The sequence is reset if the boilers have all been off for more than 9 hours.

A Fixed sequence version of the Boiler Controller is available if required (see back page for order code). This is useful where modular boilers must be brought on in a fixed sequence, such as when single and two stage boilers are mixed; or where a condensing boiler should always be first in the sequence.

The Boiler Controller can directly control 2 individual boilers or boiler stages. Additional stages can be added up to a maximum of 8 stages, by using Cascade Submodules. Use parameter **BLRS** to set the number of boilers to be controlled.



An *All Remote* feature allows all the boilers to be sequenced by Cascade Submodules, allowing the Boiler Controller status inputs to be used for general plant alarms, with each submodule monitoring the boilers.

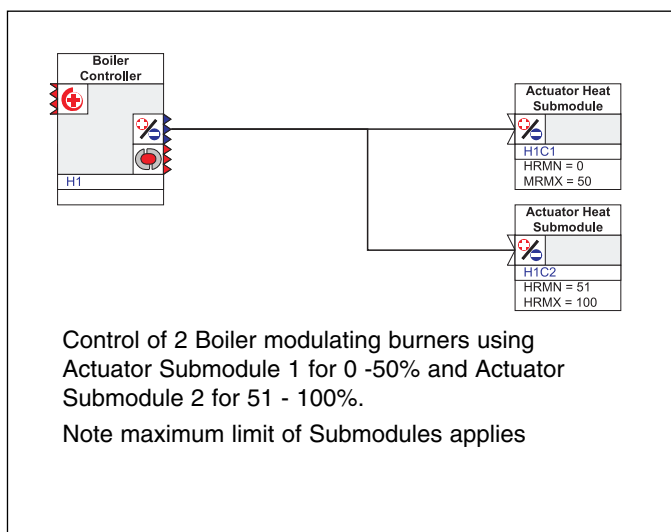


To use the All Remote feature, set **AREM** = 1 in the Boiler Controller. In this mode, boiler outputs on the Boiler Controller are disabled, and only the outputs on the Cascade Submodules are enabled. The inputs on the Cascade Submodules are used for Boiler Status/Lockout and the Boiler Controller inputs for General Alarm inputs.

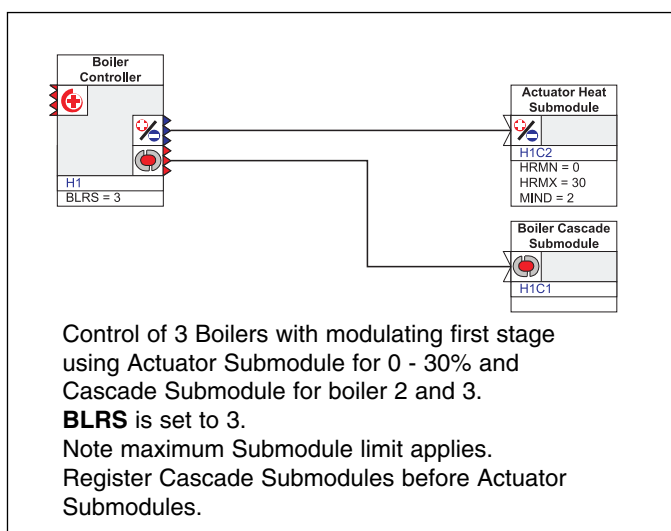
Modulating Boilers

Control of modulating boilers or combinations of modulating and normal boilers can be achieved using analogue output Actuator Submodules. Each submodule type ACT / DIN / 3T / 721 can control one modulating boiler. The submodule takes the slot of one Cascade Submodule and hence a maximum of four modulating boilers can be controlled.

Control is provided in a fixed sequence only. The Actuator Submodule Output A modulates the boiler and output B switches that boiler on/off via a relay module (i.e. Sontay IO-RM1-12VDC). Outputs on either the Boiler Controller or Cascade Submodules should not be used to switch on/off the modulating boilers.



Each Actuator Submodule should be set up to control over the Control Demand range using parameters **HRMN** and **HRMX**. For example a 2 boiler system would have the first actuator submodule set as **HRMN** = 0 and **HRMX** = 50, the second submodule would be set as **HRMN** = 51 and **HRMX** = 100. With these settings the first boiler will modulate over the first 50% of the Boiler Controller's **BLOP** output and the second will modulate over the second 50% of the **BLOP** output. The **MIND** parameter on each submodule should not be set to less than 2.



Pump Control and Demand

To maximise energy efficiency, normally the VT Pump will run only when a heating demand exists; when the Zones are satisfied, the Pump will stop and the boilers will control to the frost setting **FRST** instead of the weather compensated value. If, however, the Zone Controllers are not optimally located to give a comprehensive indication of demand from all areas, the **MIND** parameter can be set to zero. This will mean that the boilers and pumps will run, controlling to the heating setpoint (set by Weather Compensation with Zone Trim and Adaption), for the whole of the Occupation period. Alternatively, parameters in the Zone Controllers may be set to achieve a similar result while minimising the overheating effect that may otherwise occur (see Zone Controller Data Sheet for further details).

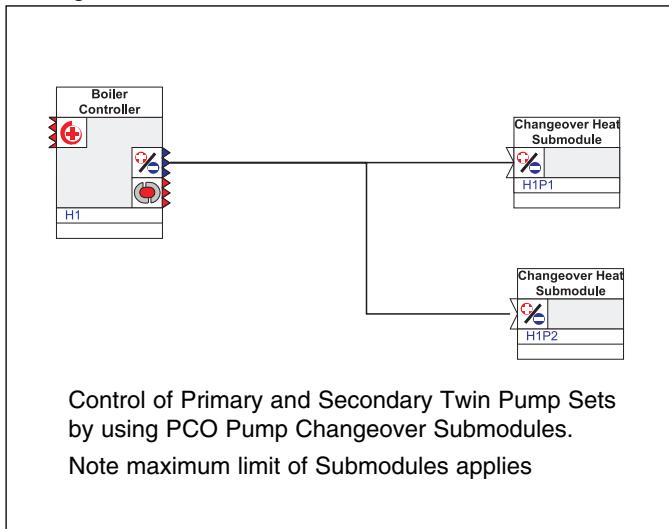
The Primary Pump is started as the first Boiler is fired and continues to run-on after the Boiler(s) have shut down. The **BRON** parameter sets the run-on time for the Primary Pump. If desired, the VT pump and Valve may be made to run-on for the same time by setting **MODE** parameter.

- MODE** = 0 Primary Pumps run for **BRON** period.
VT Pumps stopped, VT Valve shut.
Boiler circulation loop dissipates heat.
Zone valves under local control.
- MODE** = 1 Primary and VT Pumps run on and VT Valve open for **BRON** period.
Zone valves under local control.
VT circuit dissipates heat.
Useful in systems with no primary circulation loop to dissipate boiler heat.
- MODE** = 2 Primary and VT Pumps run on and VT Valve open and Zone valves overridden to 100% for **BRON** period.
VT circuit dissipates heat.
During normal running Zone valves rescaled proportional to highest Zone demand.
Useful in systems with no primary circulation loop to dissipate boiler heat and with 2 port Zone valves.

Actuator Controllers registered to Zone Controllers will normally shut their valves during a boiler run on period, as boilers are not receiving Heat Demand in this condition. When **MODE** = 2 these Zone valves are rescaled or overridden. During normal operation the valve with highest demand is rescaled to 100% open, and others are opened proportionally (e.g. if highest demand is 60% and next highest is 30% then actuators will be driven respectively 100% and 50%). During the run on period, these valves are all overridden to 100% unless they are cooling.

Twin Pump Sets

If either of the primary or secondary circuits have twin pumps sets, then they can be controlled by using Pump Changeover Submodules.



DHW Priority

The **DHWP** parameter may be set to give priority to DHW where the plant is sized for Heating or DHW, but not both, or where a fast DHW recovery is required; if this is used, the VT circuit will be disabled until all DHW services are up to temperature. Note that if **DHWP** is set but CT demands come from other controllers (e.g. AHUs) then the VT valve shuts whenever a CT demand exists.

Maintenance mode

In Maintenance mode, the Boiler Controller simulates a 50% demand signal from Zone Controllers, so the heating will control to the Weather Compensated setpoint. This is useful for commissioning during the summer months, when no heating demand exists.

The Controller is put into Maintenance Mode by holding down the Override button until the status light flashes rapidly; the Controller will stay in this mode until the button is pressed again.

Submodules

The Boiler controller can have up to 4 Cascade or Actuator Submodules and 3 Pump Changeover Submodules registered to it (type / 001 for primary pumps or flue dilution fans, or type / 002 for VT pumps). The submodule limits are reduced to 2 Cascade or Actuator Submodules and 1 Pump Changeover submodule for the / NH / non-housekeeping versions of the Boiler controller.

Frost Protection

Frost Protection is arranged as a 3-Stage sequence, which operates from a Frost Protection setpoint **FRST**.

Stage 1 is activated if the Outside Temperature falls below the Frost Protection setpoint **FRST**. The Primary and VT Pumps will run for the first 10 mins in every hour, with the VT circuit closed to the Boilers.

Stage 2 is activated as the temperature in any of the water circuits falls to 5 DegC above **FRST**. The VT Pumps now run continuously.

Stage 3 is activated if the temperature in any of the water circuits falls below the Frost Protection setpoint **FRST**. The Pumps will run, Boilers will now fire and the VT circuit will open until all water temperatures reach 30 DegC above **FRST**. An alarm **FROS** is generated to indicate that Stage 3 frost protection is in progress.

Disabling Frost Protection

Stages 1 and 2 Frost protection may be disabled; this may be useful in a Domestic installation, where the noise of pumps running during the night is intrusive, and pipework is all contained in occupied parts of the building, and is hence unlikely to freeze. The procedure is deliberately made complex, in order to avoid inadvertent use:

Access the **FRST** parameter using a Zone Controller (see our 'Design Guide' publication for details), and reduce it to its lowest allowable setting of 2°C. Now put the Boiler Controller into Maintenance Mode (see former section) and temporarily "short" the Outside Sensor connection using a wire shorting link. Refresh the **FRST** variable (by pressing Select on the Zone Controller); it will now display as 0°C, this value can now be "written" (i.e. pressing the Override button on the Zone Controller) to the Boiler Controller.

Take the Boiler Controller out of Maintenance Mode and remove the shorting link, confirm the **FRST** setting is 0°C, the variable is now fixed at 0°C and cannot be adjusted by normal methods. When frost protection is disabled, boilers will be brought on if the water temperature falls below 5 Deg C.

To re-enable frost protection, select the **FRST** parameter and put the Boiler Controller into Maintenance Mode. Press the Override button on the Zone Controller (to "write" the parameter to the Boiler Controller); the **FRST** parameter will default back to 3°C. Take the Boiler Controller out of Maintenance Mode, the '**FRST**' variable can now be set as normal to any permissible value.

Fabric Protection

Fabric Protection is an independent process operating in Zone and Slave Zone Controllers, to protect the building fabric against damage due to condensation. If the temperature in the space falls below the Non-Occupied setpoint (usually set to 10 DegC) the Zone Controller will send a demand signal to the Boiler Controller, which will start the plant in the usual manner (see Zone Controller Data Sheet Z1).

Boiler Back-End Protection

It is important that water returning to the boilers is kept above a minimum temperature (unless the boiler is a Condensing Boiler). This is in order to prevent the boiler flue gases from condensing; if this happens, the resulting condensate mixes with the products of combustion, forming a corrosive liquid which will attack the boiler.

The parameter **MINR** may be set to control the Minimum Return Temperature. In steady state conditions, if the Return Temperature falls close to **MINR**, the Flow setpoint will be raised (thus overriding the setpoint generated by demand signals from other modules).

During start-up, the Return Temperature may be low, and elevating the Flow setpoint may not be sufficient to bring the Return Temperature to an acceptable value. If the hydraulics of the system will allow, the VT Valve may be overridden to the closed position (to the Secondary Circuit) thus allowing the primary water to return directly to the boilers, and hence meet the requirements of **MINR**. As the required Return Temperature is met, the VT Valve will be allowed to open gradually until steady state conditions are reached. The VT valve will be held at the **VLIM** setting when the return is 10 Deg C below **MINR**.

The amount by which the VT Valve is allowed to close can be limited by parameter **VLIM**. If **VLIM** is set to 100, the Back End Protection Override of the VT Valve is disabled. A setting of 50 will allow the valve to close to 50%, and a setting of 0 will allow the valve to close completely.

Alarms

The Boiler Controller may be set to generate Alarms, which may be sent to a SeaChange Doorway Supervisor (either locally connected to the system, or via an autodialling modem). Alarms may be enabled by setting the **ALRM** parameter.

Alarm codes as they appear at Doorway Supervisor and InSite tool:

NOAL No Alarms.

All alarm conditions cleared in this Module.

GENA General Alarm on VFC input 'a'

GENB General Alarm on VFC input 'b'

LOKA Lockout Alarm on VFC input 'a'

LOKB Lockout Alarm on VFC input 'b'

FREZ Danger of Freezing alarm.

STOP System **STOP** alarm generated.
All outputs shut down if **ALRM** = 4 or 5.

OUTF Outside temperature Fail alarm.

FROS Frost protection in progress.

Danger of Freezing

This Alarm is generated when any of the connected water temperature sensors (Flow, Return or VT sensor) shows a reading below 5 Deg C; implying the Frost Protection strategy has failed.

Outside Sensor Failed

This Alarm is generated when either the locally wired thermistor sensor fails (to open or short circuit), or if a Networked Outside Sensor is used, the alarm will be sent if this device fails.

Frost Protection in Progress

This Alarm is generated when Frost Protection stage 3 is in operation - boilers, pumps and VT circuit enabled.

Local Indication of Alarms

Alarms are indicated by red flashing of the Temperature Indicator (Thermometer) LED. **STOP** alarms are differentiated from other alarms by flashing the thermometer LED amber and red alternately.

Alarms (Continued)

External Alarm Inputs

The 2 external inputs 'a' and 'b' may be used for monitoring purposes only, alarm generation, or alarm generation with plant shutdown. Parameter **ALRM** is used to set the desired action, and **ALST** is used to set the sense of the inputs (i.e. whether a closing or opening contact generates an alarm).

Status Monitoring Only

ALRM = 0

The status of inputs can be read on parameters **INPA** and **INPB**.

Boiler Stage Shutdown, no Alarms

ALRM = 1

Often used for Maintenance switches, or Summer/Winter Boiler changeover switches.
Input 'a' shuts down boiler 1.
Input 'b' shuts down boiler 2.

Boiler Lockout Alarm

ALRM = 2

Used for Lockout signals
Input 'a' generates **LOKA** alarm only.
Input 'b' generates **LOKB** alarm only.

Boiler General Alarm

ALRM = 3

Used for General alarm signals
Input 'a' generates **GENA** alarm only.
Input 'b' generates **GENB** alarm only.

General Plant Shutdown, Stop Alarm

ALRM = 4

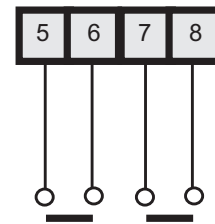
Used for external critical alarms
Input 'a' will generate a **STOP** alarm, shut down all Boiler Controller outputs, and also all other plant which is set to respond to a **STOP** alarm (e.g. fire link).
Input 'b' will generate a **GENB** alarm, but will not cause plant to shut down.

General Plant Shutdown, Stop Alarm

Boiler Shutdown, or Master Off Alarm

ALRM = 5

Used for external critical alarms
Input 'a' will generate a **STOP** alarm, shut down all Boiler Controller outputs, and also all other plant which is set to respond to a **STOP** alarm (e.g. fire link).
Input 'b' will generate a **GENB** alarm, and shutdown boilers only (eg pressurisation unit failure).



Input 5-6

Input 7-8

ALRM = 0

VFC input 'a'

VFC input 'b'

Inputs used for monitoring only
Plant continues to run
No Alarms

ALRM = 1

Inputs used for maintenance
Plant shuts down
No Alarms

ALRM = 2

Inputs used for Lockout alarms
Plant continues to run
Alarms reported

ALRM = 3

Inputs used for General alarms
Plant continues to run
Alarms reported

ALRM = 4

Inputs used for **STOP** alarm
Plant shuts down on **STOP** alarm
Alarms reported

ALRM = 5

Inputs used for **STOP** or Master Off
Plant shuts down on **STOP** alarm
Boilers shut down on **GENB** alarm
Alarms reported

System Housekeeping Functions

In a conventional Wet Heating environment, the Boiler Controller performs several important housekeeping functions for the rest of the system.

Firstly, it contains the real-time clock, which broadcasts time-of-day and day-of-week information to any modules that may need it. The clock may be set from any Zone Controller, and the time information is backed up by a Capacitor, which means that the correct time is retained for a minimum of 8 hours in the event of power failure (providing that power has been applied for at least 1 hour).

Secondly, it broadcasts Outside Temperature to any other modules that may need it; it acquires the temperature either from a sensor directly connected to its input terminals 15 and 16, or from a Networked Outside Temperature Sensor. In the absence of both sensors, it will transmit a default value of 0.1 DegC lower than the Frost Setpoint (**FRST**).

Thirdly, it performs an important role in the unique SeaChange Registration process; it is responsible for the automatic allocation of system addresses during registration. It also keeps track of all Registered Controllers, so that if one of them fails, a replacement will be automatically allocated with the address of the failed module. This automatic feature may prove troublesome when commissioning large systems, so it can be disabled using parameter **RPLN**. When Commissioning is complete, the automatic mode can be re-instated. For further details, see our 'Design Guide' publication.

Secondary Boilers - No Housekeeping

In systems having 2 or more independent sets of boilers, (e.g. Campus installations with multiple Boiler Houses) Boiler Controller versions / NH / *with No Housekeeping* must be used. These controllers are supplied with the System Housekeeping functions disabled, to avoid conflicts with the Boiler Controller versions / SH / *with System Housekeeping*. Thus, in a system with 3 independent boiler plants, we would use 1 Boiler Controller version / SH / *with System Housekeeping*, and 2 Boiler Controllers / NH / *with No Housekeeping*.

Note that the Boiler Controller version / NH / *with No Housekeeping* can have a maximum of 2 Boiler Cascade or Actuator Submodules and 1 Pump Changeover Submodule registered to it, see **Submodules** section.

Multi-Domain Systems

Large systems may need to have their networks structured into more than one Domain. Boiler Controllers in a Multi-Domain system will require setting of the **DOMN** parameter, see our 'Design Guide' publication for details.

Commissioning

Setup Mode : Timing Characteristics of the VT Valve

It is possible to set the stroke time for the VT valve using pushbuttons.

Raise/Lower Types - Setting Stroke Time

- 1 Hold down Select until Temp lamp flashes**
Temperature indicator will flash red at one second intervals.
Release select button; VT valve close output will energise to close valve.
- 2 When valve is closed press Select**
Temperature indicator will flash green and VT valve open output will energise to open valve. The controller is now measuring the stroke time.
- 3 When the valve is open press Select**
Flashing will stop and stroke time is now set and stored in non-volatile memory. This time will be retained until the procedure is repeated.

Note: if a Stroke Time of less than 30 secs is set using pushbuttons then the setup process is aborted. Temp indicator flashes amber rapidly for 5 secs indicating an invalid period. This allows checking of wiring without affecting Stroke Time setup. Stroke Times less than 30 secs can be entered manually via Zone Controller or InSite tool using parameter **PERD**.

Manual Override

Allows the outputs to be exercised during commissioning and maintenance activities. Holding the *override* button pressed until the Status Lamp flashes green will cause the controller to be switched from automatic control to *Override Mode*.

- 1) Hold down Override until Status lamp flashes**
Controller changes to Override Mode and simulates 50% Zone Demand, allowing boilers to control to Weather Compensated Setpoint. Useful for commissioning in summer months.
- 2) Press Override again**
Controller cancels Manual Override and reverts to automatic control.

As this feature does not time out, care should be exercised to ensure the module is returned to the automatic mode on completion of the commissioning or maintenance activities.

Manual Override (Continued)

Occupancy Override can also be achieved via Doorway and InSite; using **AUTO** and **OVRD** monitoring parameters. The status lamp indication shows a different sequence.

Override from Off to ON :

Status lamp flashes long ON, short Off

Override from ON to Off :

Status lamp flashes long Off, short ON

See our 'Design Guide' publication for details of the Override features.

Registration

Registration is the simple process by which logical connections are made between Controllers in a SeaChange system; it is done during commissioning and involves pressing buttons on the Controllers in a specific sequence.

For further details of the registration process, see our 'Design Guide' publication.

Address Allocation and System Housekeeping

Boiler Controllers versions / SH / *with System Housekeeping* provide the System Housekeeping service for the whole SeaChange system. See our 'Design Guide' publication for a full explanation of this feature. The Boiler Controller keeps a Database containing the module addresses that it has allocated. Boiler Controllers *with System Housekeeping* are factory-set to address H1 (B1 also works with Doorway pages), and do not need to be registered to obtain an address. If the Register button is pressed, nothing will happen.

The maximum number of main modules that can be registered to a Boiler Controller with System Housekeeping are:

Address Class

H	Heat Source	20
	Boiler Controller	
	Secondary Circuit Controller	
C	Cool Source	20
	Chiller Controller	
	Secondary Circuit Controller	
A	AHU Controller	50
Z	Zones	100
	Fan Coils/VAV	
	DHW	
	Door Heater	
	Pool Controller	
	Alarm Annunciator	
	Meter Reader	
M	Monitoring Modules	25
S	Communications	4
	Serial adaptor SLT	
R	Routers	4

Boiler Controller versions / NH / *with No Housekeeping* must be registered in the normal way to the SeaChange module that has System Housekeeping. The Boiler Controller *with No Housekeeping* will be allocated an 'H' class address by the System Housekeeper, see our 'Design Guide' publication.

Check that you have an appropriate System Housekeeping module, see our 'Design Guide' publication.

Interconnects

The Boiler controller must receive signals from a Zone Controller, or another Energy Consumer (e.g. Fan Coil Controller) or Distributor module (e.g. Secondary Circuit Controller). It may also send signals to other modules (e.g. a Pump Changeover submodule to control twin pump sets).

These Interconnects are put in place by Registration; again, see our 'Design Guide' publication.

Monitoring Parameters

Label	Doorway / InSite Code	Description	Units	Default Value	Range
INPA	I1 (C30)	External input 'a' status	-	-	0 to 1
INPB	I2 (C31)	External input 'b' status	-	-	0 to 1
BLRA	I3 (C32)	Boiler 1 output status	-	-	0 to 1
BLRB	I4 (C33)	Boiler 2 output status	-	-	0 to 1
PPMP	I5 (C34)	Primary pump output status	-	-	0 to 1
VTOP	I6 (C35)	VT valve open output status	-	-	0 to 1
VTCL	I7 (C36)	VT valve close output status	-	-	0 to 1
VPMP	I8 (C37)	Secondary pump output status	-	-	0 to 1
AUTO	W1 (C38)	Automatic/Manual Status	-	-	0 to 1
OVRD	W2 (C39)	Override	-	-	0 to 1
SHOF	W3 (C40)	Summer heating (inhibited if SHOF = 1)	-	read only	0 to 1
ZBST	W4 (C41)	Zone boost (disabled if ZBST = 0)	-	1	0 to 1
HAND	W5 (C42)	Manual HAND mode	-	0	0 to 1
RPLN	W6 (C43)	Replace missing nodes in Database (for SH types only)	-	1	0 to 1
SERV	W7 (C44)	Service Pin Message (to Doorway and InSite, self resetting)	-	-	0 to 1
CGST	W8 (C45)	Configuration Mode Status	-	-	0 to 1
FLOW	S1* (C50)	Flow Temperature	Deg C	-	-
RTRN	S2* (C51)	Return Temperature	Deg C	-	-
VTMP	S3* (C52)	VT circuit Temperature	Deg C	-	-
OUTS	S4* (C53)	Outside Temperature (logged in SH types only)	Deg C	-	-
FLSP	S5 (C54)	Primary Temperature Setpoint	Deg C	-	-
BLOP	S6 (C55)	Boiler Output	%	-	-
VTPN	S7 (C56)	VT Valve Position	%	-	-
ZDMD	S8 (C57)	Maximum Zone Demand	%	-	-
VTSP	S9 (C58)	VT Setpoint	Deg C	-	-
MAXF	K1 (C60)	Maximum Primary Setpoint	Deg C	80	0 to 100
MINR	K2 (C61)	Minimum Return Setpoint	Deg C	40	0 to 100
Engineering Parameters; only accessible via Doorway and InSite					
TYPE	C24	Output type (for SeaChange use only)	-	-	1 to 3
NOAL	C90	No Alarms; all alarms cleared when set to 1	-	-	0 or 1
GENA	C91	General Alarm input 'a' (when set to 1)	-	-	0 or 1
GENB	C92	General Alarm input 'b' (when set to 1)	-	-	0 or 1
LOKA	C93	Lockout Alarm Boiler 1 (when set to 1)	-	-	0 or 1
LOKB	C94	Lockout Alarm Boiler 2 (when set to 1)	-	-	0 or 1
FREZ	C95	Danger of freezing (when set to 1)	-	-	0 or 1
STOP	C96	STOP alarm (when set to 1)	-	-	0 or 1
OUTF	C97	Outside temperature failed (when set to 1)	-	-	0 or 1
FROS	C98	Frost protection stage 3 in progress (when set to 1)	-	-	0 or 1
<p>* 24 hour plots available for these values by default Plotting interval and plotted variable changeable via Doorway or InSite</p> <p>Parameter details were correct at product software revision 4C1. Details of current version can be seen on website.</p>					

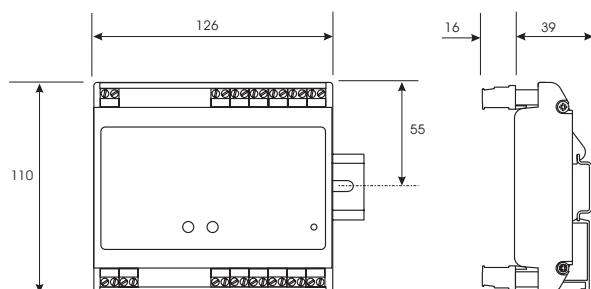
Configuration Parameters

B1

Label	Doorway InSite Code	Description	Units	Default Value	Range
FRST	C1	Frost Protection / Non Occupied Setpoint	Deg C	3	2 to 15
MAXF	C2	Maximum Primary Setpoint	Deg C	80	30 to 110
MINR	C3	Minimum Return Setpoint	Deg C	40	10 to 50
FLAV	C4	Flow Temperature for 10°C outside temperature	Deg C	50	20 to 100
SACT	C5	Sensor Action 0: Use flow or return, or average if both sensors valid 1: Use flow sensor value 2: Use return sensor value 3: Use average of flow and return sensor values	-	1	0 to 3
BLRS	C6	Number of boilers in sequence	-	2	1 to 8
MXVT	C7	Maximum VT circuit water temperature	Deg C	80	20 to 100
VLIM	C8	Limits the opening of VT valve if return temp is below MINR 0%: Valve will close fully if Return > 10 Deg C below MINR 50%: Valve will close 50% if Return > 10 Deg C below MINR 100%: Valve will control normally, no limitation	%	100	0 to 100
DHWP	C9	Hot Water Priority: 0: Hot water and heating have equal priority 1: VT valve closes when DHW is demanding heat	-	0	0 to 1
MIN	C10	Boiler minimum run time	mins	5	1 to 20
BRON	C11	Primary pump run on time	mins	5	0 to 30
PERD	C12	VT valve stroke time	secs/10	18	2 to 60
TRNG	C13	Maximum trim effect on heating setpoint	Deg C	10	0 to 20
CRNG	C14	Maximum adaptive effect on heating setpoint	Deg C	10	0 to 20
MODE	C15	Mode select: 0: VT Valve held shut while Primary Pump only runs on Actuator demands match zone heat demand 1: VT Valve opened while Primary and VT Pumps run on Actuator demands match zone heat demand 2: VT Valve opened while Primary and VT Pumps run on All actuators opened proportional to highest zone demand and overridden fully open while boiler pumps run on	-	0	0 to 2
BLOK	C16	Number of boiler stages available to run (i.e. not locked out)	-	read only	0 to 8
AREM	C17	All boilers remote 0: Boiler outputs on controller included in sequence 1: All boiler stages via cascade modules Boiler Controller outputs disabled	-	0	0 to 1
SMRT	C18	Summer heating inhibit if outside temperature > SMRT	Deg C	20	10 to 30
MIND	C19	Minimum Demand for Boiler Controller to operate 0: When demand drops to zero, boilers and pumps continue to run MIND > 1: When demand drops to zero, boilers and pumps stop	%	2	0 to 10
COMP	C20	Compensator offset	Deg C	0	-50 to 50
ALRM	C21	Alarm Mode 0: Ignore alarms 1: Disable Boiler outputs, no alarm (maintenance switches) 2: Report all alarms, continue running (lockout alarms) 3: Report all alarms, continue running (general alarms) 4: Report all alarms, shut down on STOP alarm only 5: Report all alarms, shut down on STOP alarm or "Master Off"	-	0	0 to 5
ALST	C22	Alarm report sense 0: Alarm if input = 0 (contact open) 1: Alarm if input = 1 (contact closed)	-	1	0 to 1
DOMN	C23	Own Domain (for SH types only)	-	0	0 to 8

Parameter details were correct at product software revision 4C1. Details of current version can be seen on website.

Dimensions



all dimensions in mm

Electrical

Inputs 4 Thermistor sensors
2 Volt-Free contacts

Outputs 6 Relay Outputs N/O contacts
3A 250V resistive load

Consumption 13mA from network
50mA from 24V ac aux supply
(or system PSU aux supply)

Physical

Weight 0.25 kg

Cover Material PC/ABS alloy Self extinguishing to UL 94 V0/1.60

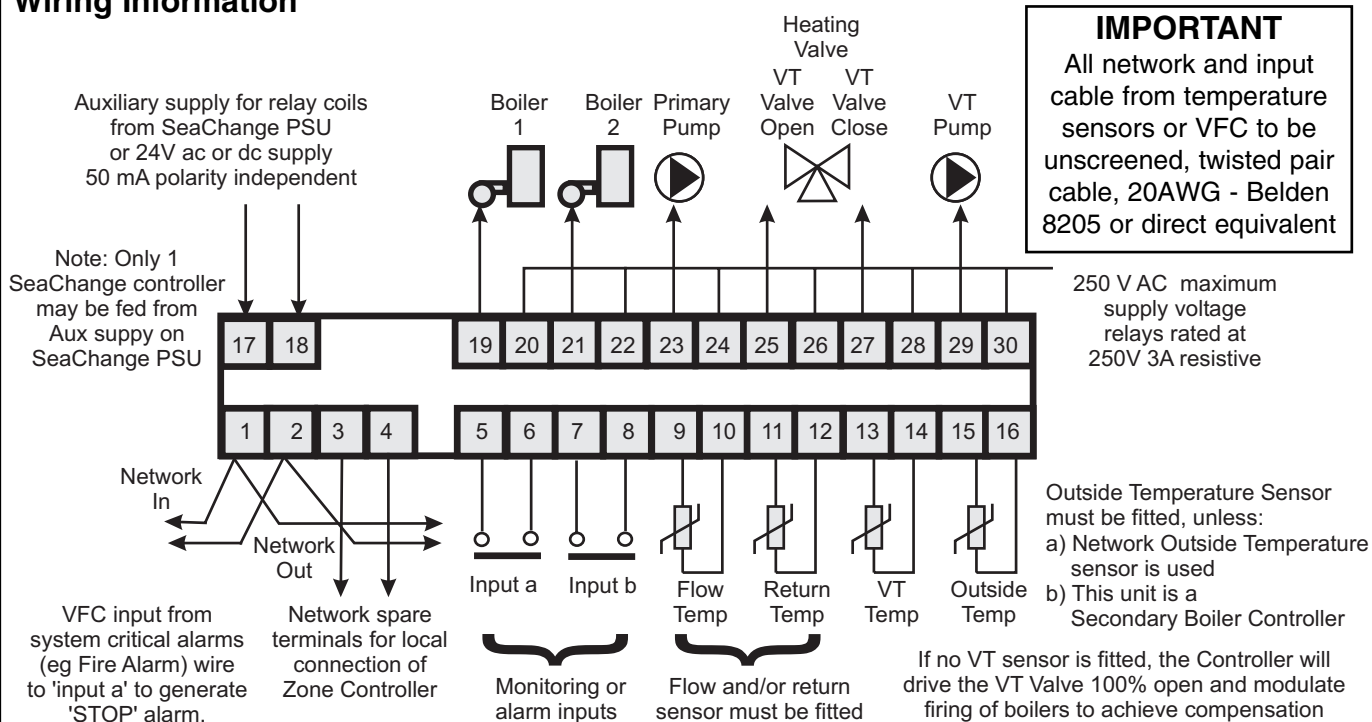
Base Material Polyamide 6.6 Self extinguishing to UL 94 VO

Colour Dark Grey to Pantone 425



Conformant product

Wiring Information



Options and Product Codes

Boiler Controller Module

BLR / DIN / STD / [housekeeping] / [driver option]

Driver options		Max Submodules	
Option		Cascade	PCO
/ SH / 001	with duty and sequence rotation, with housekeeping	4	3
/ SH / 003	with fixed sequence, with housekeeping	4	3
/ NH / 004	with duty and sequence rotation, no housekeeping	2	1
/ NH / 006	with fixed sequence, no housekeeping	2	1

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